M234 / M235 / M236 SELF-DESTRUCT FUZES

OUTLINE

- Self-Destruct (SD) Fuze Objectives
- SD Fuze Requirements
- KDI SD Fuze Design and Operation
- Safety Test and Army Certification
- Type Classification Test Results
- High Rate Fuze Equipment Status
- High Rate Battery Equipment Status
- Product Improvements
- SD Fuze Schedule
- Summary

SD Fuze Objective

- Reduce the Number of Hazardous DPICM Grenade Dud Submunitions on the Battlefield

Advantages:

- Enables Maneuverability
- Reduces Clean-up Efforts
- Addresses Humanitarian Issues

U.S. Army SD Fuze Requirements

- Artillery (M234)
  - 97% Primary Mode (Ground Impact)
  - 99.8% Tactical Mode (Includes SD Function)
- ER-MLRS (M235)
  - Less Than 1% Hazardous Duds
  - Less Than 5% UXO (Fly-Off Requirement)

KDI's SD Fuze Key Design Feature

- Two Autonomous Fuzing Systems
  - PD Primary
  - Electronic Time SD
- Mechanical Arming of Primary Fuze Not Required to Arm SD Fuze
- Only SD Fuze Type Classified for U. S. Army and U. S. Navy Utilization

105 MM → ERGM →

5" 54 → XM982 →

ER-MLRS → GMLRS →

Background Fuze Operation

- SD Fuze Replacement for M223 Designed to Reduce the Number of Submunition Duds
- Minor Differences Between Artillery and MLRS Fuze
- Primary Mode of Operation
- Self-Destruct (Secondary) Mode of Operation

Self-Destruct Fuze Operation

1 2

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Safety Testing

- MIL-STD-331-B Testing ✔
- Detonator Out-of-Line Testing ✔
- New Shunt Design / Testing ✔
- E3 Testing ✔
- Power On Reset ✔
- Grenade Stack Test ✔
- Propagation Test ✔
- EOD Issues ✔
  - Ribbon Color
  - Battery Bleed Down
- Energetics Compatibility ✔
- Approved Fuze Fault Tree ✔
- MIL-1316 Checklist ✔

Army Certifications

- M234 Type Classified 24 Mar 98
- M235 Type Classification Paperwork in Process
- M236 Passed U.S. Army Safety Certification Firings
- Approved Fuze Fault Tree
- Approved MIL-1316 Checklist
  - Waiver For Stored Energy Granted
- M234/235 Granted AFSRB Final Safety Certification
- Fuze Line Qualification Planned For 4th Quarter 2003
- Fuze First Article Planned For 4th Quarter 2003

M234 SD Fuze Artillery Test Result

TEST	*CONFIGURATION*			
	Primary Only		*Tactical*	
Grenade Functioning	(30/2585)	98.84%	(3/1439)	99.79%
Air Drop	(21/1081)	98.0%	(0/156)	100%
Initial Safety & Sequentia	(193/8125)	97.4%	2/1350)	99.9%
DT&E Total		97.6%		99.83%

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M235 SD Fuze MLRS Test Results

DVT TESTING

Temperature / Range	Reliability	
Hot @ 48Km	(5/461)	98.9%
Ambient @ 25Km	(2/1014)	99.8%
Cold @ 16Km	(9/1012)	99.1%
Weighted Mission Total:		99.52%

FOR VALIDATION, CALL:
AMSTA-AR-FSA-P
MR. Leon Springer
(973) 724-2208

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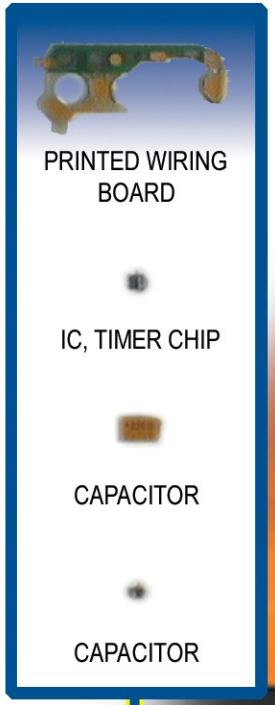
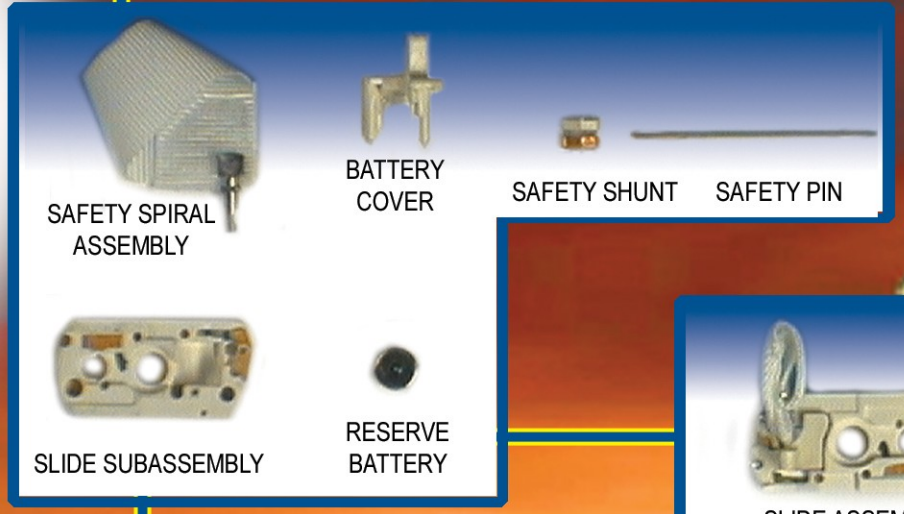
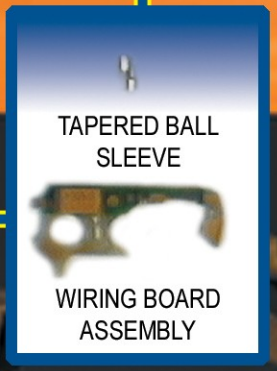
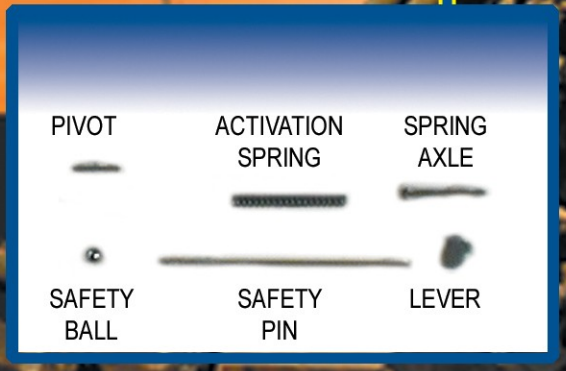
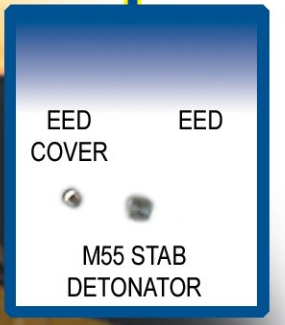
SELF-DESTRUCT FUZES M234 (ARTILLERY) / M235 (ROCKET)











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Self-Destruct Fuze Assembly Line

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Palomar Products Chip on Board
Printed Wiring Board (PWB) Assembly (Machine) Status

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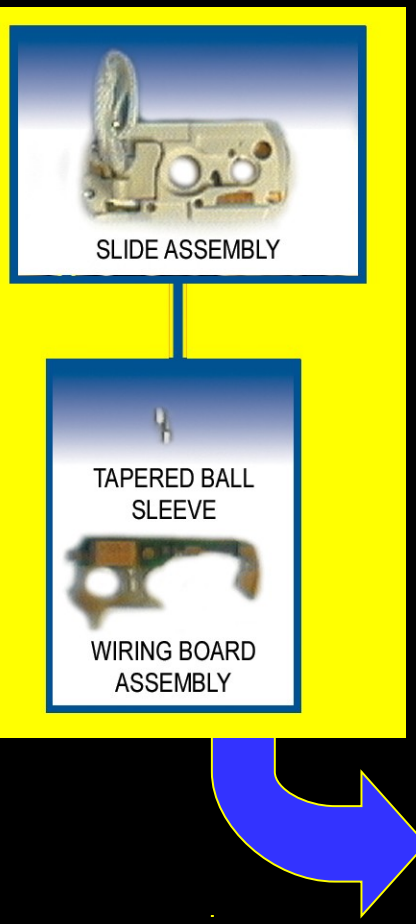
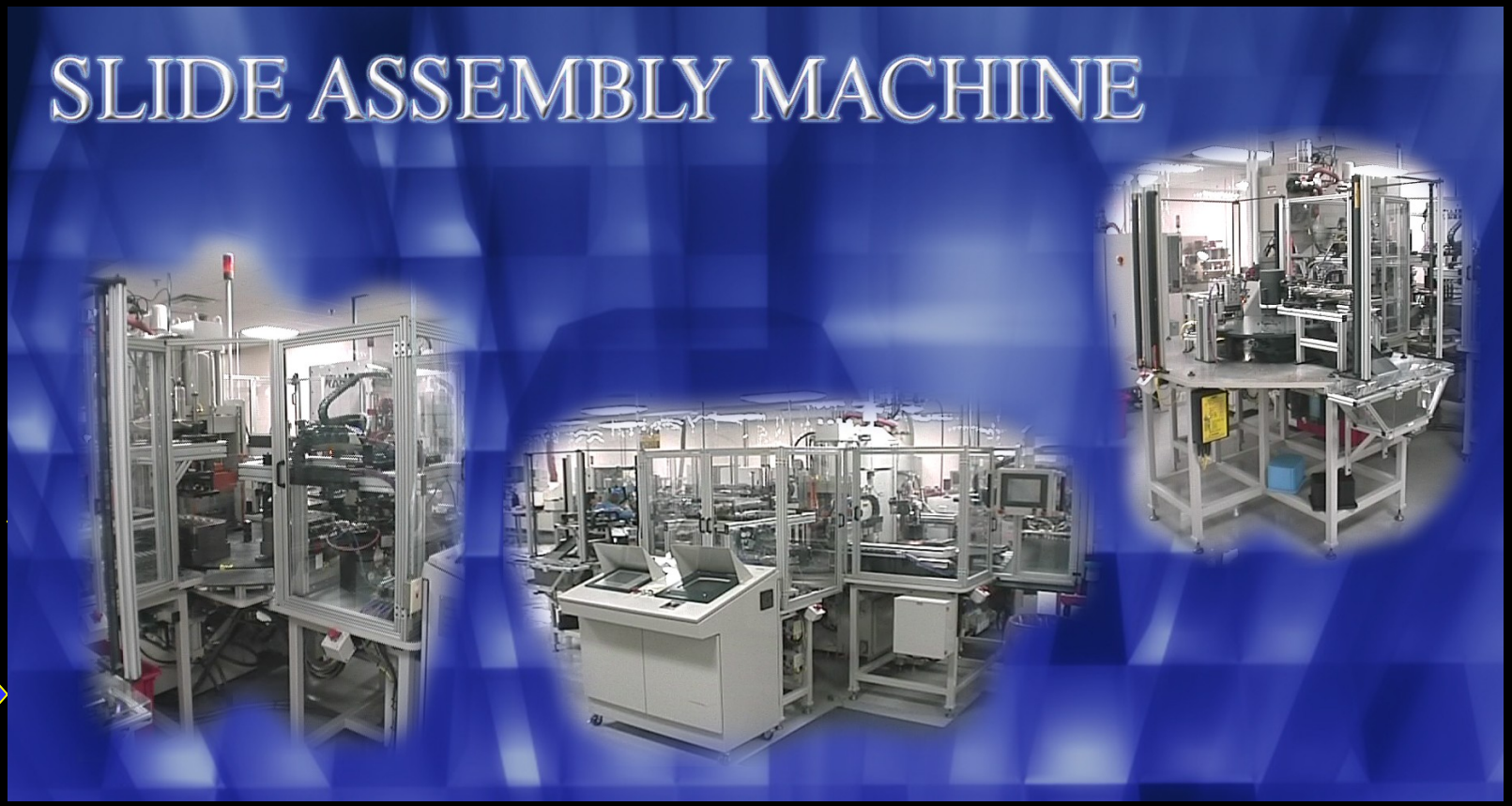
Printed Wiring Board (PWB) Assembly (Machine) Status

- Palomar Line
  - Palomar Line Has Been Accepted a Rate
  - Palomar Line Is Production Ready

Slide Subassembly Machine





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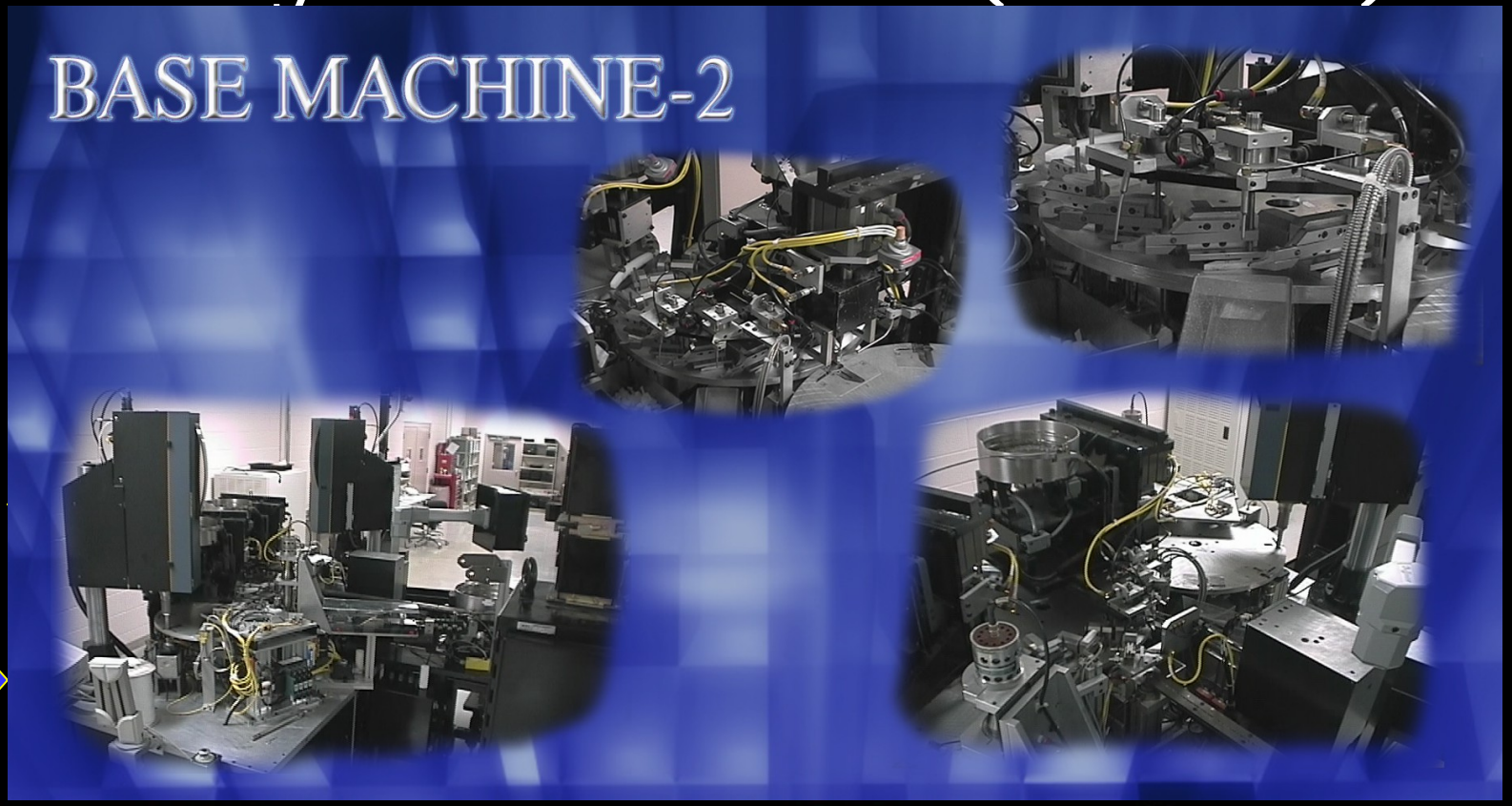
Slide Subassembly Machine Status

- QSI Machine
  - QSI Line Has Been Accepted at 100% rate
  - QSI Line Is Production Ready

Spiral Safety Flag Assembly Machine (BM-2)



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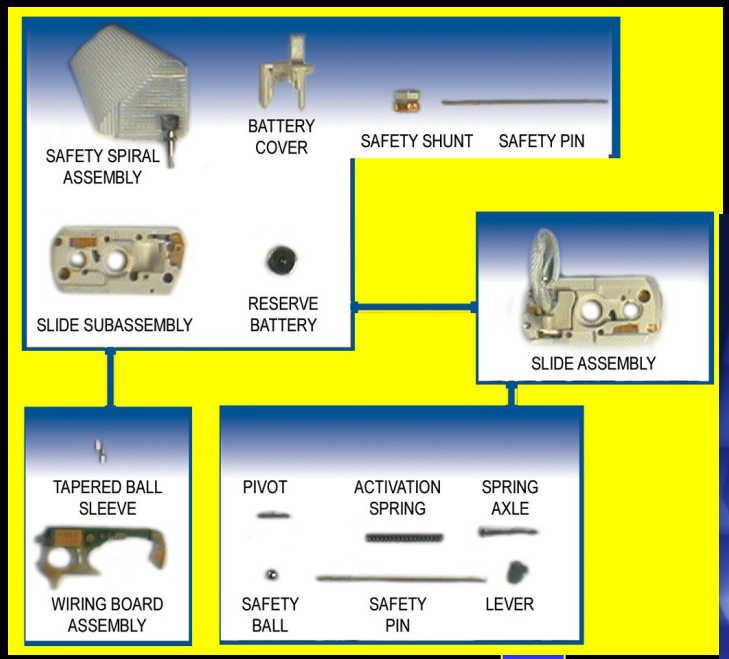
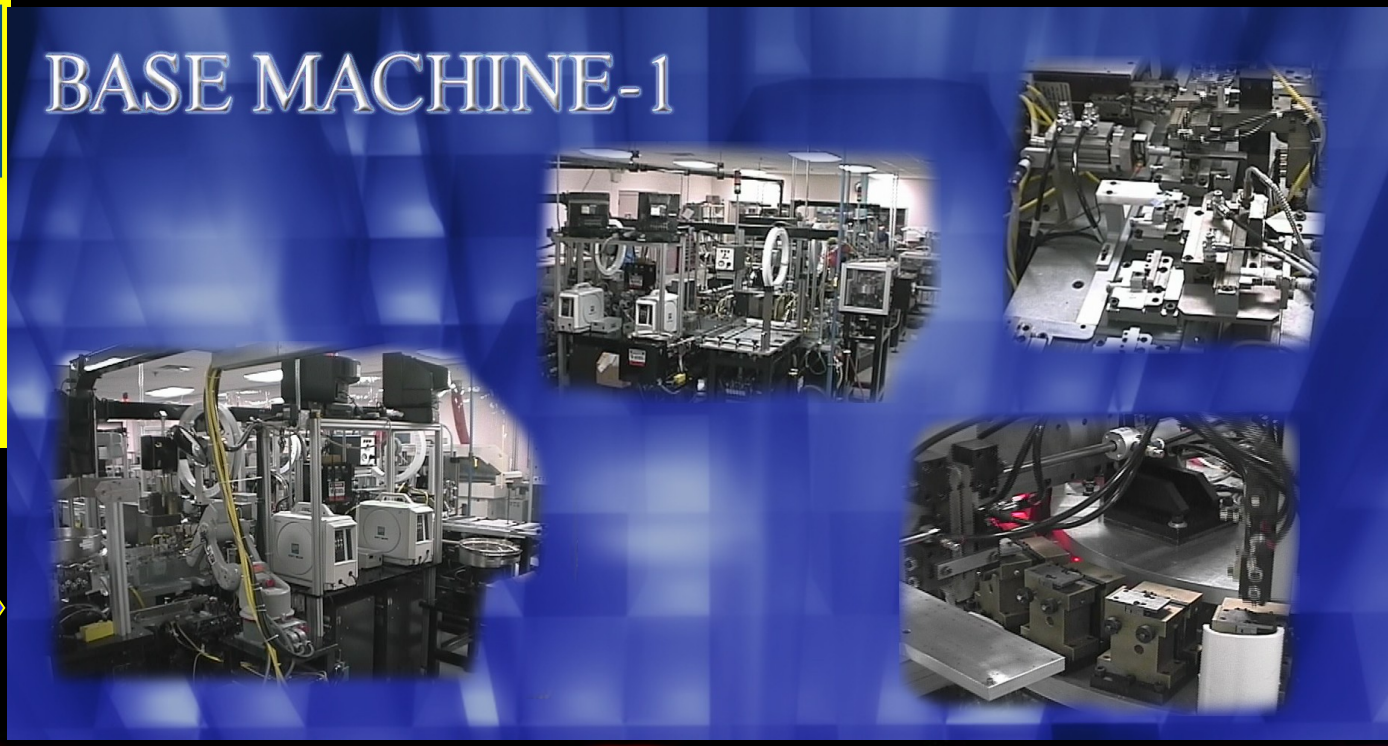
Spiral Safety Flag Assembly Machine (BM-2) Status

- Base Machine #2 (BM-2) Has Tilted Spiral Flag Assembly
  - BM-2 Has Been Accepted at 100% Rate
  - BM-2 Is Production Ready

Slide Assembly Machine (BM-1)





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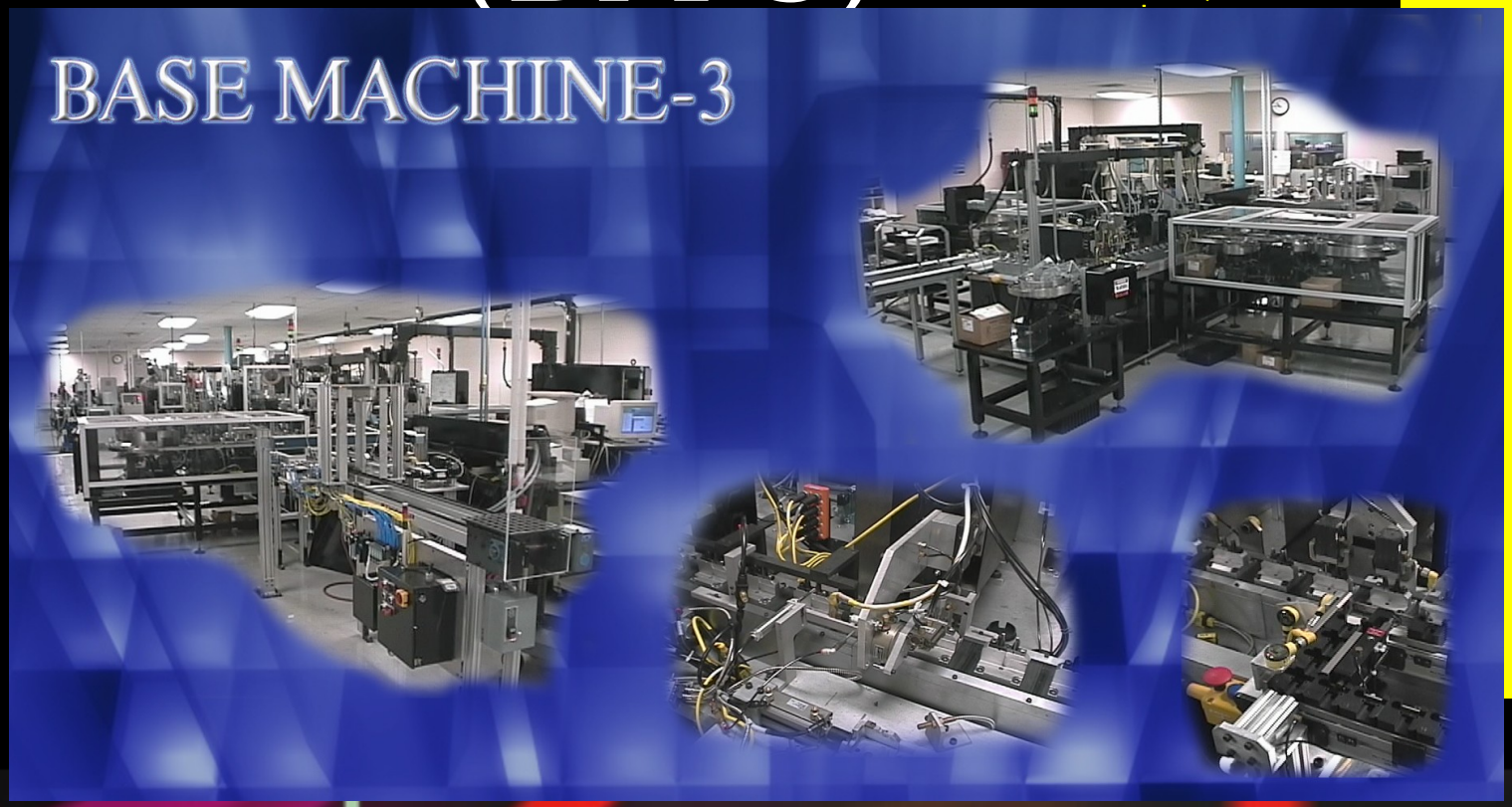
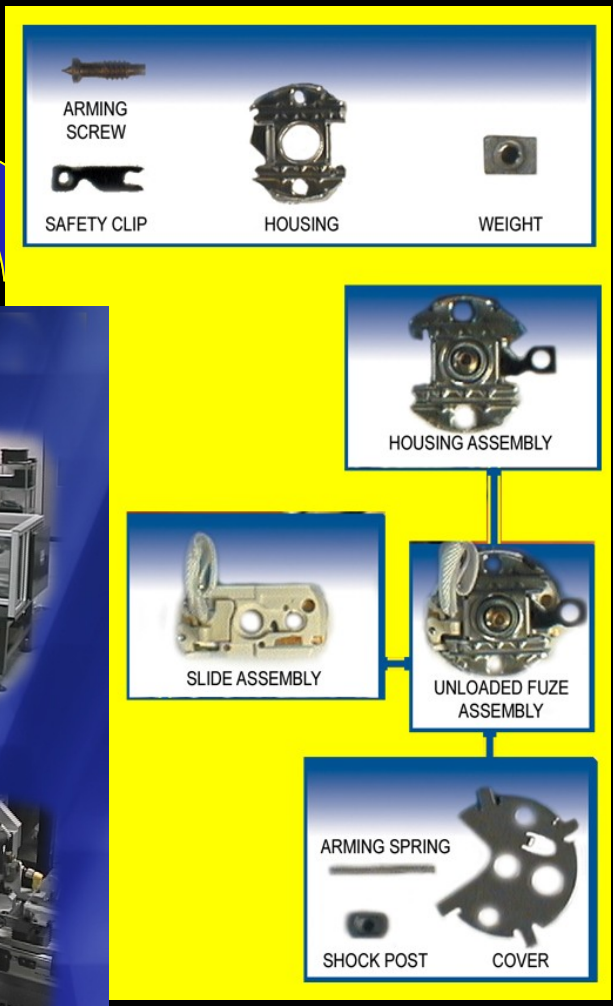
Slide Assembly Machine (BM-1) Status

- Base Machine #1 (BM-1) - Slide Assembly
  - BM-1 Has Been Proven Out at Rate
  - BM-1 Meets Product Quality Requirements
  - Final Acceptance Is Scheduled for First Quarter 2004
  - Final 100% Acceptance Is Prior to 200,000 Production Units

Unloaded Fuze Assembly Machine (BM-3)





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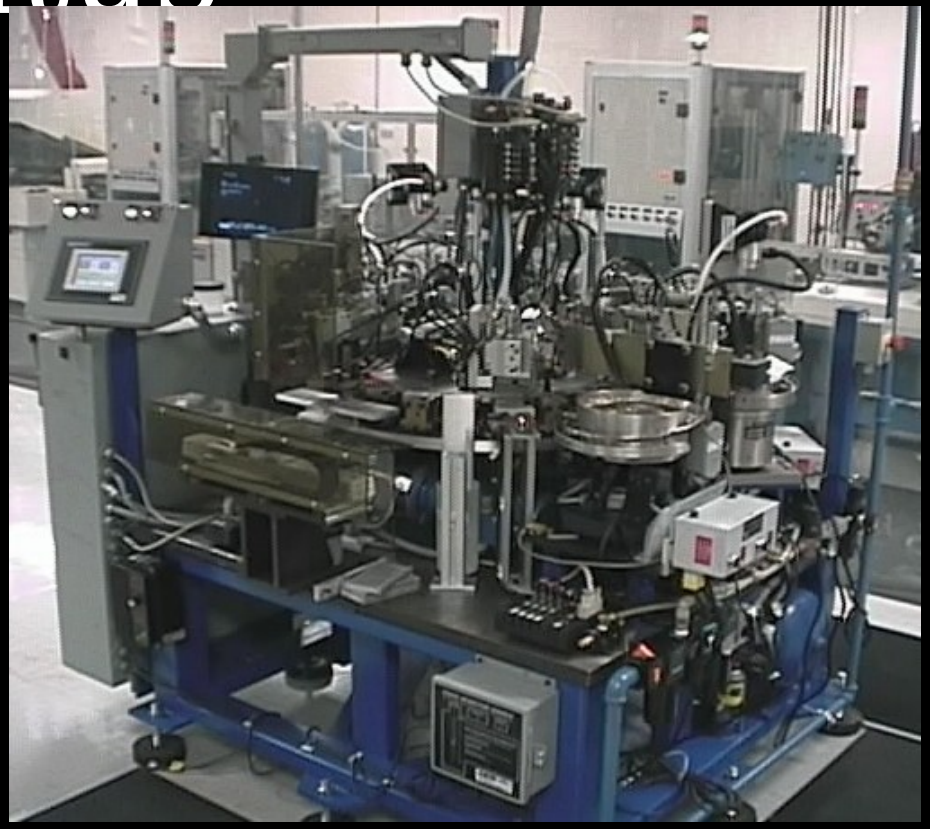
Unloaded SD Fuze Assembly Equipment Status (BM-3)

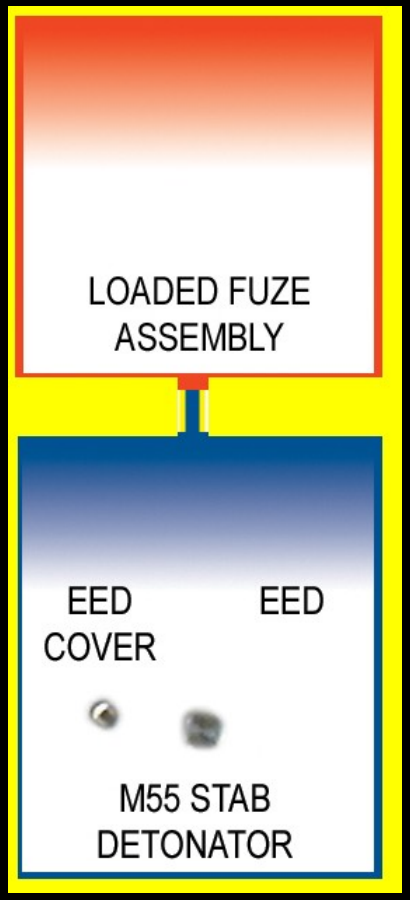
- Base Machine #3 (BM-3) - Fuze Assembly
  - BM-3 Has Been Accepted at 96% Rate
  - BM-3 Final Acceptance Will Be First Quarter 2004
  - BM-3 Is Production Ready

Shunt Assembly Machine Status

- Proven Out at Datum At 100% Rate
- Shunt Machine is Production Ready



SDF Loading Equipment



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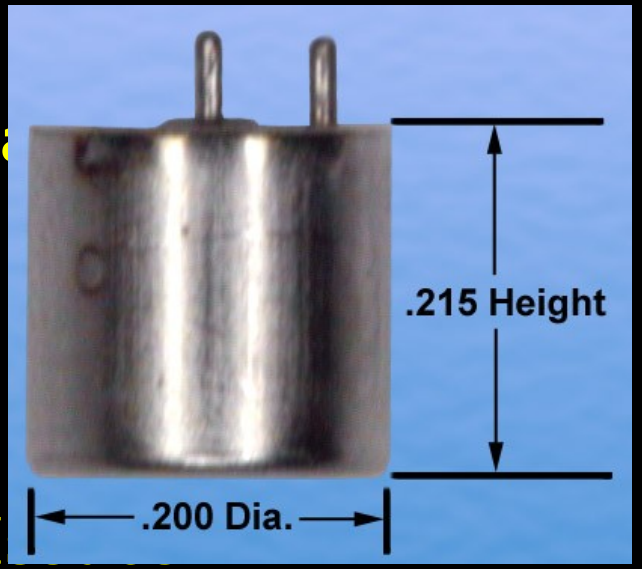
SDF Loading Equipment Status

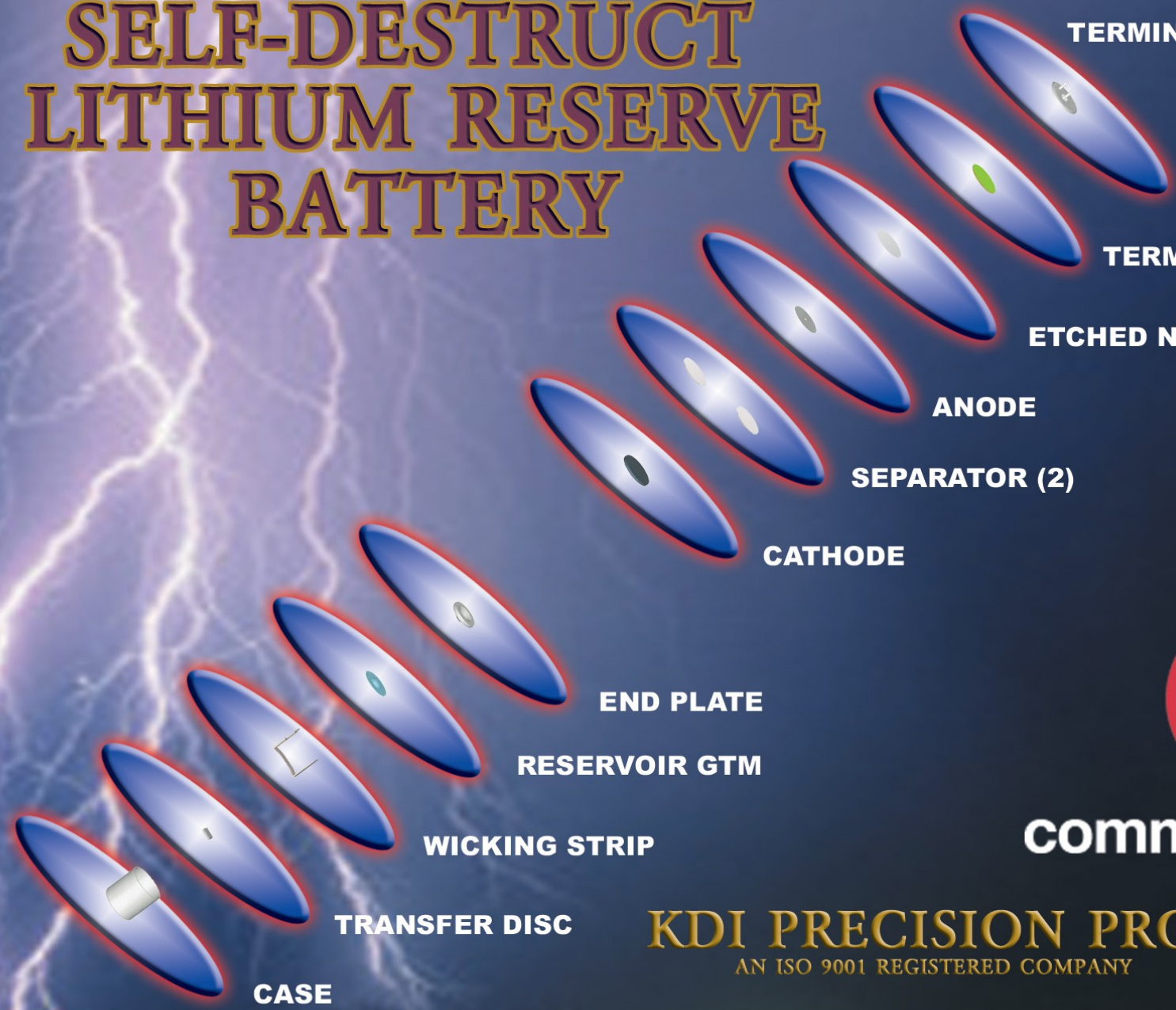
- SDF Loading Equipment Has Been Proven Out at 75% Rate
- Final Acceptance Is Scheduled for First Quarter 2004
- Equipment Production Ready

Lithium Reserve Battery Line

- Battery Design Was Completed by ATK and Qualified
- High Rate Equipment Was Not Acceptable
- New Equipment Has Been Purchased From RD Systems
- Contract Awarded To RD Systems in Ma
- Battery Line Was Installed At KDI in August 2003 (In Debug)
- KDI Has Retained THALES USFA, Netherlands to Consult on All Battery I



SELF-DESTRUCT LITHIUM RESERVE BATTERY



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SDF Battery Animation

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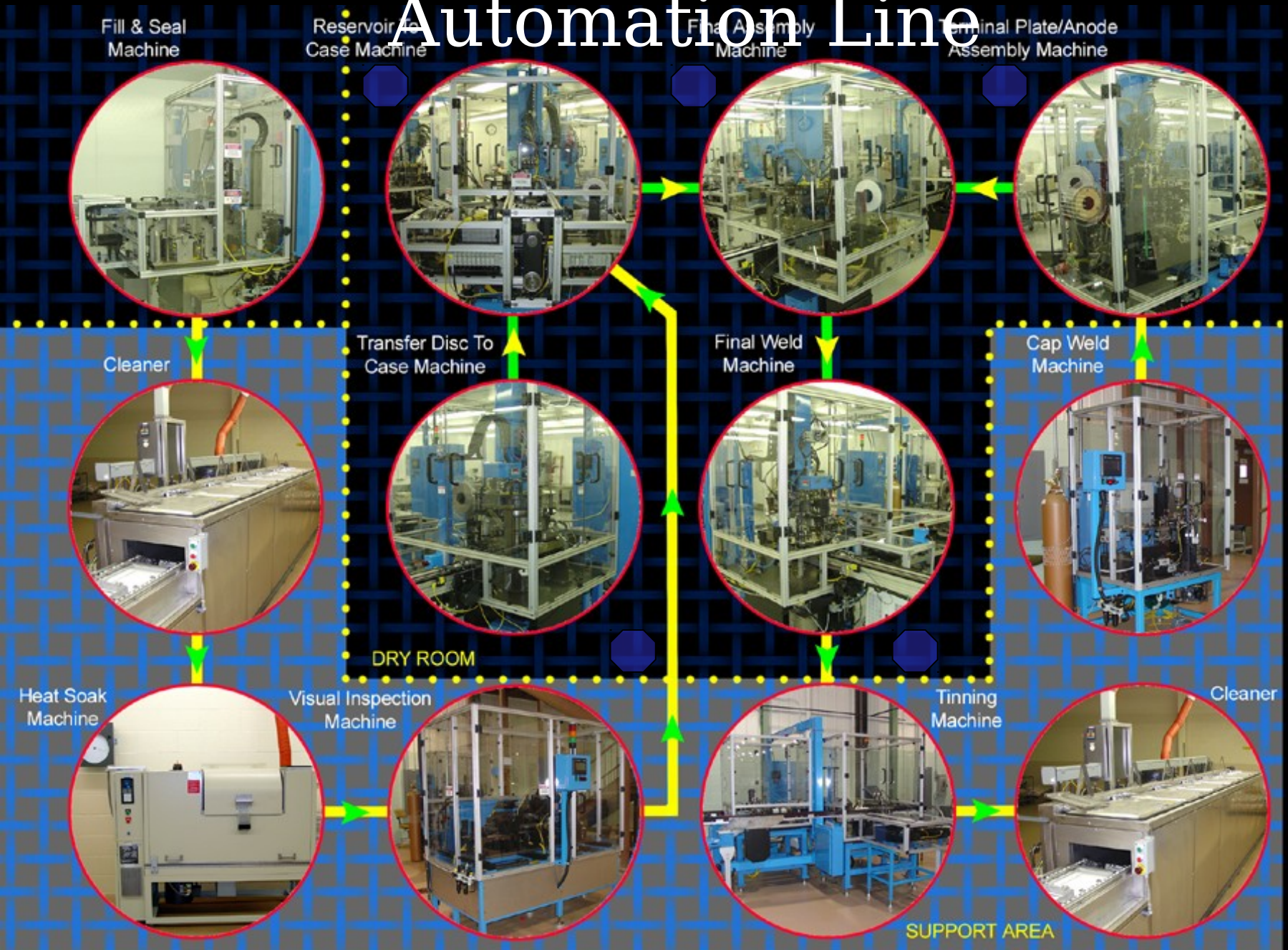
Lithium Reserve Battery

- Contract Structure
- Unique Battery HRE Contract
  - Preliminary Design Review (PDR)
    - Ampule Fill & Seal (Process)
    - Lithium Lamination Process
  - Brainstorming Review
  - Critical Design Review
    - Each Machine/Process
  - Release Component Fabrication
  - Proveout at RD Systems
  - Modified First Article
  - Final Acceptance KDI

Lithium Reserve Battery Automation Line



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SELF DESTRUCT BATTERY MANUFACTURING PROCESS FLOW

Legend

Direction of Flow

Dryroom

Manual Feed

Conveyor Feed

SDF (PIP)

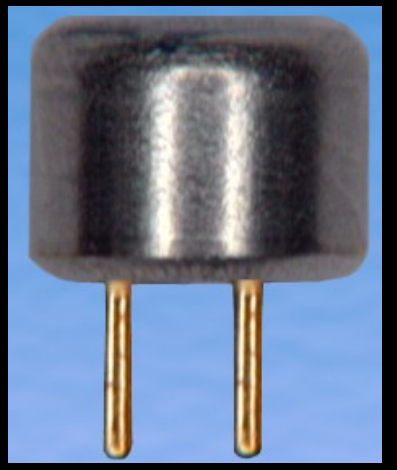
- Two (2) Integrated Product Improvements
  - Packaged EED
  - Packaged IC

SDF (PIP) Current EED Design

- The Current EED Has Three (3) Explosive Elements That Are Loaded Into the Fuze and Consolidated
- After Consolidation, a Cover and Encapsulate Are Placed on Top of the Explosive Elements

SDF (PIP) Packaged EED Design

- The Packaged EED Is a Two (2) Pin Hermetic Sealed Detonator



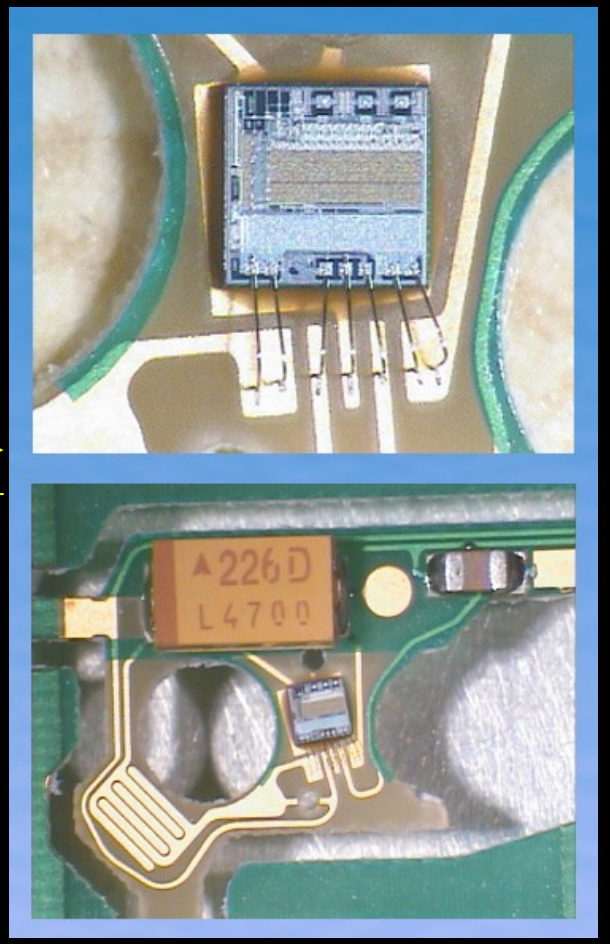
- The Packaged EED's are Inserted Into
- Receptacles That Are Surface Mounted on the PWB

SDF (PIP) Packaged EED Advantages

- Reduces the Printed Wiring Board Complexity
- Assembly Process Is Less Complicated
- Lot Acceptance Can Be Performed at the Component Level
- Explosive Output Is 1.5 Times Greater
- Requires Less Energy to Fire

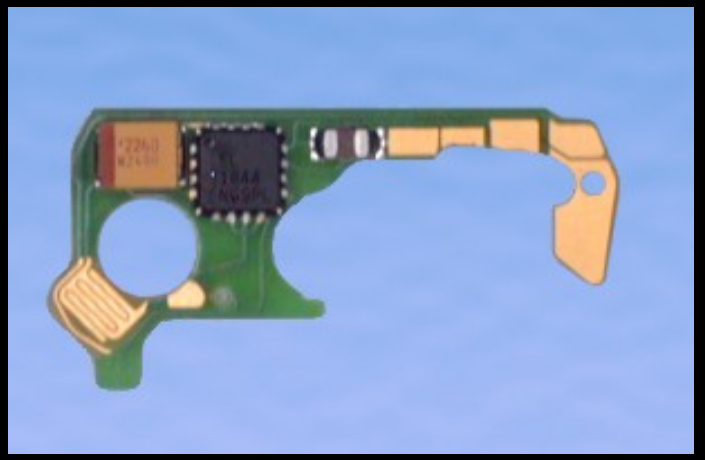
SDF (PIP) Current IC Assembly Design

- The Current PWB Employs Chip-on-Board (COB) Technology



SDF (PIP) Packaged IC Assembly Design

- The Packaged IC Design Contains the Same Die Which Is Placed in an Micro Lead frame Package



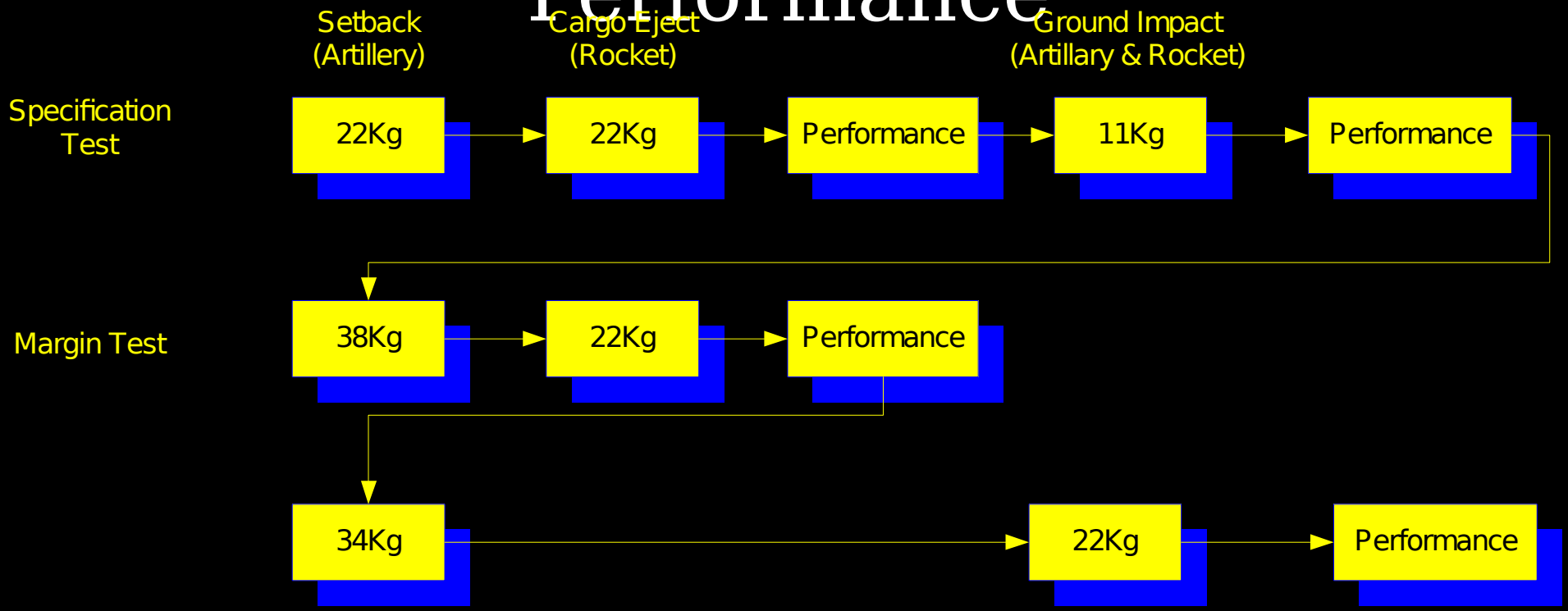
SDF (PIP)Packaged IC Advantages

- Assembly Is Greatly Simplified
- Increase in Throughput
- Increase in Yield
- Test at the Component Level
- Design Is More Robust

SDF (PIP) Test History

- Packaged EED → Qualified to MIL-I-23659 by USN
- Packaged IC → Structural Test to Confirm Robustness
- Flight Test → Worst Case Environments

SDF (PIP) Packaged IC Structural Performance



- Both Specification and Margin Test Were Performed on the Same Hardware Set
- Test Performed Following 160 Thermal Shock Cycles (Specification Requires Eight)

SDF Warm Line & GMLRS Fly Off Tests (PIP) Flight Test

• M915 Artillery	FVT: Performance 99.88% Flight: March 03
• M915 Artillery (Hot)	FVT: Performance 99.98% Flight October 03
• M915 Artillery (Cold)	FVT: Performance 99.99% Flight October 03
• GMLRS @ 16 Km	FVT: Performance 100% Flight: March 03
• GMLRS @ 20 Km	FVT: Performance 100% Flight: August 03
• GMLRS @ 65 Km (Hot)	FVT: Performance 100% Flight: December 03
• GMLRS @ 65 Km (Cold)	FVT: Performance 100% Flight: December 03
• GMLRS @ 19.5 Lm (Cold)	FVT: Performance 97% Flight January 04

GMLRS Mission Reliability 97% UXO's & 99.6% Hazardous Duds

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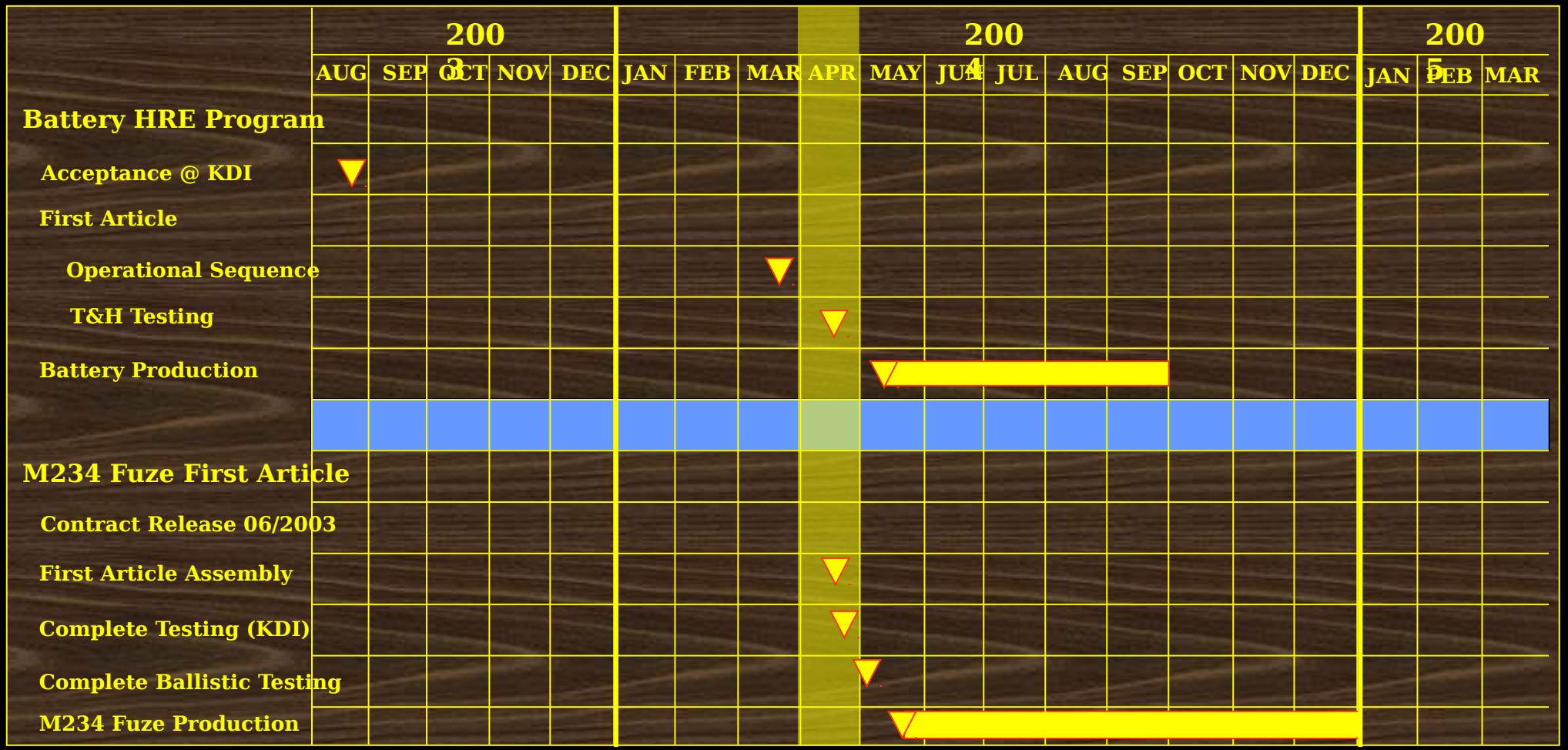
SDF Integrated Schedule



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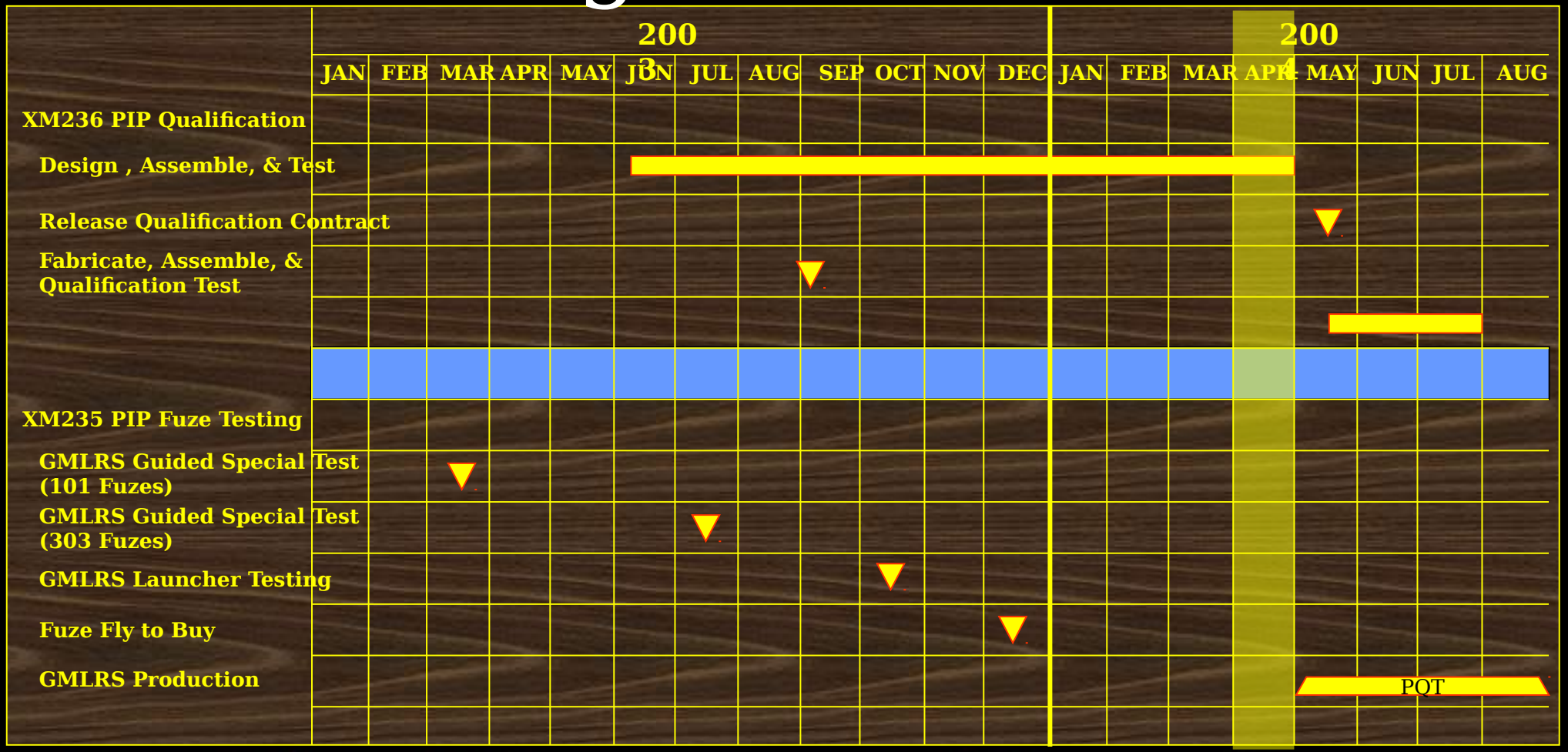
SDF Integrated Schedule


2003
2004
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG
XM236 PIP Qualification
Design , Assemble, & Test
Release Qualification Contract
Fabricate, Assemble, & Qualification Test
XM235 PIP Fuze Testing
GMLRS Guided Special Test (101 Fuzes)
GMLRS Guided Special Test (303 Fuzes)
GMLRS Launcher Testing
Fuze Fly to Buy
GMLRS Production
PQT

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